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ABSTRACT

This study measured and compared the pre- and post-course differences in college students' attitudes toward and achievement in an asynchronous, Web-based, health profession course. The distance course included 14 Web-based learning modules that students could complete at their own pace prior to finishing the end of the term. The course also involved learner interaction through e-mail, discussion boards, and telephone. The study used a single group pretest and posttest design with volunteer participants from an upper level, Internet-based course on neurological rehabilitation. Students completed a pre- and post-course attitude survey and test of knowledge (related to established course learning objectives). Data analysis indicated that the learning modules were effective. There was an overall improvement in student attitude toward education and enhanced learning of content that was presented asynchronously. Six appendixes include: identified domains related to achievement motivation, the survey on attitudes toward education, and tables and graphs. (Contains 45 references.) (SM)

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Changes in Student Attitudes Regarding in a Web-Based Health Profession Course

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Abstract

Technological enhancements over the past decade have increased both the feasability and practicality of delivering education and learning at a distance. Characteristics of the non traditional student seeking distance learning opportunities is well documented, however, the characterization of traditional students enrolling in distance courses is less extensive. Traditional students often enter learning situations with preconceived attitudes regarding the delivery of the academic content. Determinants of preconceived attitudes include time demands, previous academic experience, and the significance of the course related to long term career plans. The purpose of this investigation was to measure and compare the pre and post course differences in student attitude and achievement in a web-based college level course. The investigative methodology consisted of a single group pretest and posttest design with participants that volunteered from an upper level collegiate Internet-based course. Significant data was observed demonstrating an overall improvement of student attitude toward education and enhanced learning of the content that was presented asynchronously. Attitude toward learning is a multifaceted composite of characteristics related to the learner that may vary from learning situation to learning situation, but the analyzed data suggest that improvements in data may be related to gains in the self reported scores surrounding to the fear of failure, social acceptance, future orientation, competitiveness, and anticipatory behavior. While significant data was produced, limitations of the study include the inherent threats presented in the single group investigation design. Future research is needed to carefully identify the nature of the student seeking learning through technologically enhanced means as well as instructional design elements that lend to successful learning.

Introduction: Use of Technology to Deliver Learning at a Distance

Technological enhancements over the past decade have increased both the feasability and practicality of delivering education and learning at a distance. The use of computers to deliver Internet-based instructional materials have recently infiltrated many aspects of higher education to provide supplementary as well as stand alone learning experiences. Moore and Kearsley (1996) describe distance education as a planned learning event that occurs in a different place from the instruction. The nature of the separation between the instructor and learner requires special techniques in instructional design, communication efforts, and organized institutional and administrative efforts. Phipps & Merisotis (1999) state that distance learning includes both synchronous and asynchronous means of communicating. Synchronous communication occurs when the instructor and the learner are present at the same time during instruction, even though the two may be physically in different locations. Asynchronous communication results when the learner and the instructor are not in direct interaction at the same time or place. Distance learning is also characterized by the instructional and learning processes that occur when the learners are at a distance from the originator of the instructional material. A combination of media may be utilized to distribute learning at a distance including television, videotapes, audiotapes, video-conferencing, audio-conferencing, e-mail, telephone, fax, Internet, computerized software, and print based media. The operative element for the delivery of learning at a distance is the convenience of the learner rather than that of the institution. Providing educational environments that can be accessed at anytime of the day on any day of the week have lead to the development of asynchronous learning networks (ALN) that provide educational opportunities that are physically separated from traditional education institutional setting. In this era of rapidly changing technology, it is critical to assess and evaluate the effectiveness of educational

technology and distance learning (Carew et al. 1997).

The distance education student has been labeled in the literature as a non-traditional student. Moore and Kearsley (1996) state that the vast majority of distance learners are between the ages of 25 and 50 and are seeking the element of saving time by completing the educational process at a distance. Conversely, Dominquez (1999) reports that the majority of students enrolling in online courses at Christopher Newport University are at the first and second year levels and tend to combine online with traditional offerings. Convenience of time is critical as the student enrolling in distance education has relatively little time to attend a traditional classroom setting or does not have a traditional classroom setting that is readily accessible to the nearby vicinity. Student reasons for enrolling in distance education courses include the flexibility in course scheduling and the freedom to not commute (Phipps & Merisotis, 1999, Dominquez, 1999). While the range of leaning topics and content is varied, the common element that Moore and Kearsley describe among the distance learner is that these students tend to be serious about their education, committed to complete the task, and very motivated. Powell et al. (1990) attempted to describe the characteristics of the successful distance learning student with success being defined as a newly enrolled distance education student passing their first computer-assisted course. Self-reported characteristics of the successful distance learning student included: 1) high levels of persistence, 2) belief that the consequences of not passing as serious, 3) belief that they will succeed compared to others, 4) ability to work alone, 5) good time management skills, 6) goal oriented behavior, and 7) a belief that they are well prepared academically. Demographic data that related to the successful distance learning student included: 1) married status, 2) high literacy levels, and 3) being female. This description, while not exclusive of traditional students, does not comprehensively describe the average student that

attends a traditional bricks-and-mortar academic unit.

Characteristics of the traditional learner that are predictive of academic success in higher education have been exhaustively documented in the literature, however, a clear and simple path to predictive success has not been well established. Ory and Poggio (1975) reviewed the pertinent historical literature and identified 15 domains or characteristics (see appendix A) that are predictive of achievement motivation. While a single predictive factor for motivation and attitude is desirable, it is clear from the literature that attitude toward education and achievement motivation are not a unidimensional constructs. Factors impacting a learner's attitude in the educational setting appear to be compiled from a set of more specific traits blending together (Ory and Poggio, 1975; Rampp and Guffey, 1999).

As the use of distance learning technology expands to the traditional higher education setting, historical instructional design elements geared toward the non-traditional student may need to be modified to include the traditional bricks-and-mortar academic institution. Traditional students often bring preconceived attitudes regarding the delivery of academic content to the learning experience which are shaped by time demands, previous academic experience, and the significance of the course related to long term career plans (Powell et al. 1990). Asynchronous classroom delivery to the traditional student may create undo anxiety and stress as the uncertainty of the learning experience presents. Traditional students may fear the unknown, the technology, or the unfamiliar environment. Perceptions of ineffectiveness and increased time demands may negatively impact the learning experience for the traditional student in a technologically enhanced learning environment. Very little publish data exists distinguishing the characteristics, attitudes, and rationales for distance course enrollment by traditional students when compared non traditional student enrollment (Moore and Kearsley, 1996).

As technologically mediated distance education expands its service areas and tests new educational waters, many critics have judged the use of technology to deliver learning without a face-to-face primary as inferior and ineffective. Many of these claims are unfounded, yet not disproved either. The inherent battle in academics was established placing the use of computer mediated asynchronous learning networks against the traditional classroom environment. The use of computers as instructional tools is debatable due, in part, to a lack of adequate controlled experimental investigations to accurately assess it's comparative effectiveness as an instructional modality (DeAmicis, 1997; Toth-Cohen, 1995). There is striking evidence to the fact that there exists a relative paucity of true, original research dedicated to explaining or predicting phenomena related to distance learning (Phipps & Merisotis, 1999). Many studies have been conducted to scientifically prove that the computer mediated and other technologically enhanced means of delivering education at a distance is not only effective, but efficient. Likewise, there have been an equal number of studies conducted to show that student satisfaction is best suited with the traditional lecture based mode of inquiry. The use of technological enhancements and computerized interactions to deliver the content message of instructors to learners at a distance, rather than relying on the Socratic method of face-to-face lecture, discussion, and dialogue is what has made the current views of distance education simply a novelty (Moore & Kearsley, 1996).

Billings (1986) cites advantages of using computers to deliver instruction that include the ability to use several instructional strategies, vary instructional events, individualize instruction, provide accessibility, promote consistency, and facilitate privacy in learning. The author also reports that the time for learning can be reduced by 25-33%. Hmelo (1989-90) also concluded that the use of computers to deliver content in allied health profession education serves to

consistently decrease the time spent on the educational intervention. Examples of technologically enhanced educational delivery styles using the Internet as the medium include 1) audiographic supplements of text, 2) videographic supplements of text, 3) the virtual class room which incorporates email, discussion boards, listservs, and chat rooms in place of live classroom interactions, and 4) multimedia enhanced text based self paced tutorials with an instructor as a facilitator (LaRose et al. 1998; Althaus, 1997; Yaverbaum & Nadarajan, 1996).

There have been many theories describing the benefits of computer assisted instruction. A critical mass of scientific investigations has been conducted attempting to prove the overall effectiveness of enhanced learning through technologically driven interactions. Hazari & Schnorr (1999) believe that the interactive medium provided by the computers and the Internet allow for opportunities for immediate feedback and assessment in order to monitor students progress, the pace of learning, or to evaluate instructional design. Three factors appear to determine the effectiveness of feedback: 1) the degree to which the feedback provides useful information about the correctness of the response, 2) the immediacy of the feedback, and 3) the level of the involved material. Therefore, feedback is influenced by learner characteristics such as confidence and competence in the material to be learned (Waldrop, Justen, Adams, 1986). Feedback from learners can provide the instructor with a formative evaluation of teaching during the semester allowing for appropriate course corrections and modifications. Immediacy of feedback and the engagement of the learner has provided some of the most powerful elements of this interactive instructional tool (Hazari & Schnorr, 1999).

Introduction: Student Perceptions and Attitudes to Web Based Education

Berube et al. (1999) suggested that the increase utilization of computer assisted

instruction and the use of the Internet may indicate that there exists a greater acceptance of this mode of instruction as an adjunct to learning. Interaction and feedback are major components influencing a learners motivation to complete an Internet-based course and lessen the psychological distance that is present in asynchronous learning networks (Moore & Kearsley, 1996; Cornell & Martin, 1997; Comeaux, 1995). Internet interactivity helps to engage learners in the active application of content, principles and values, and provides them with feedback that promotes understanding, growth, and maturity (Hazari & Schnorr, 1999). Lepper and Gurtner (1989) believe that the use of computer-assisted instruction works to increase the motivation of the student in the classroom.

Several authors have taken the position that the use of computers to deliver educational content is received positively by the learners. Wegner et al. (1999) reported that in a comparison of traditional to Internet-based courses, online students had a more positive feeling about their learning experience than did the control group. Dominquez (1999) reported that, while no significant difference was present in student evaluations of online versus face-to-face courses, the online students enjoyed not coming to class and believed the writing exercises during the class were harder than traditional course work. Rajendran et al. (1990) suggests that students positively perceive the use of computers as a learning tool and that the use of computers may actually assist to produce more effective learning. Larson (1994) reported that a majority of graduate level nursing students were very positive regarding their distance learning experience and would request similar opportunities in the future when made available. Students perceived that the adjunct use of computer programs was helpful and useful in promoting learning in human anatomy courses (Walsh & Bohn, 1990). Carew et al (1984) reported that the majority of students utilizing computer assisted instruction found it to be useful while only a small

percentage (2.5%) believed it to be of no significant benefit.

Shea (1999) identified nine different correlations related to factors that influence student satisfaction and motivation in online courses. Online learners in the age range of 36 to 45 had the highest level of satisfaction with their academic performance. Online learners who had self reported low levels of computer skills reported the highest level of satisfaction with the educational experience. Women tended to demonstrate higher levels of satisfaction than did their male counterparts and women were more likely to enroll in a second online course. Learner reasons for taking an online course impacted self reported attitudes where those students who reported that the reason for taking the course was due to time and family constraints were more satisfied than learners who took the online course because it was not offered in a traditional class room. Learners who experienced lower levels of technical difficulties while online reported greater satisfaction with the experience. Learners who were very satisfied with the asynchronous learning experience believed that they learned more than they otherwise would have in a traditional course. Increased interaction with fellow online classmates correlated into perceptions of increased learning. Higher levels of online participation by the learner produced perceptions of increased learning. Lastly, when the learner perceived good interaction with the instructor, high levels of satisfaction and learning were reported.

Some studies have concluded that attitudes are not impacted or are negatively impacted during the interaction with the technologically enhanced classroom. Stevenson (1999) found no differences between post course evaluations of like courses taught by the same instructor in successive semesters with differing modes of delivery (online versus face-to-face). Martin and Rainey (1993) found no significant difference between the attitudes of students who took a regular high school classroom course in anatomy and physiology when compared to a like group

of students who took the same course through interactive satellite. Cheng et al (1991) found a significant difference in the overall perception of instruction between three groups of learners: computer-assisted, face-to-face, and correspondence. The perceptions of the computer-assisted learners was significantly less positive than that of the conventional classroom students.

Regarding the nature of how student attitudes are affected by the use of computerized instruction, there exists little evidence to guarantee learners could or would learn more from the technological interaction (Bennett, 1991). Bennett (1991) concludes that it is plausible to use computers as an adjunct to learning that may enhance achievement, but the substitute of computers as the primary mode of instruction should be questioned. It is apparent that student attitudes improve toward the use of computers and instruction through the interaction with the computerized instruction, but not necessarily to the subject matter being studied. Students learn more quickly when using supplemental computer instruction and may be of greatest benefit to the disadvantaged student with lower abilities. Bennett argues that there exists great promise for the use of computers as a supplement, but there remains a significant need to identify specific interactions that will enhance learning.

Introduction: Student Achievement Related to Web Based Education

Russell (1999) published an annotated bibliography summarizing the effectiveness of educational technology in a distance education environment. Over 350 articles, publications, and dissertations are presented claiming that there exists no significant differences impacting the learning effects when comparing the technological modes of delivering education at a distance. Boucher et al. (1999) found no significant difference in the achievement posttest scores when comparing the type of instruction received (lecture based vs. computer enhanced). Dominquez

(1999) found no differences in the final grades of online courses compared to like face-to-face courses. Wegner et al. (1999) found no significant differences between test scores of an experimental group of learners that received Internet-based instruction when compared to a control group of learners enrolled in face-to-face instruction courses. Kinney et al. (1997) reported the results of an investigation conducted at the Medical College of Georgia utilizing physical therapy students that "there was no significant differences in post-test scores between the [computer assisted instruction group] and lecture groups" when learning the content related to carpal tunnel syndrome. No significant difference was found in the performance of students who used computer based videodiscs and those students who utilized cadaver demonstration (Guy & Frisby, 1992). Walsh and Bohn (1990) reported that no significant differences were observed between final examination scores of the students who utilized the computer assisted instruction and those who did not. Thompson (1987) found no significant difference in using CAI and written programmed text for the performance and retention of learning in physical therapist assistant students. Schmidt et al. (1991) found no significant difference between the use of computers to deliver learning and traditional lecture for teaching content in a nursing program. Barker (1988) found no significant difference between written exam scores and motor performance scores in professional physical therapy students who used CAI to learn sliding board transfers. Justen, Adams, and Waldrop (1988) found no significant difference in the achievement outcomes of students working individually or in small groups with computer-assisted instruction.

Some scholars have reported that the use of computers did produce benefits in enhancing achievement over other modes of instructional delivery. Carew et al. (1984) found statistically significant differences in the final average grade of a course in which students utilizing computer

assisted instruction achieved higher scores than the students who elected not to use the supplemental instructional aid. Belfrey and Winne (1988) reported that nursing students that used computers assisted instruction learned more in a less amount of time than the students that received traditional instruction. Cloninger et al. (1988) demonstrated that post-test scores were significantly greater for students that utilized computer simulation programs for inventory management in a college level nutrition program when compared to students who did not utilize the program. Martin and Rainey (1993), who found no differences in student attitudes, did however find a significant difference on an achievement test with students who attended an interactive satellite based classroom achieving greater scores when compared to students in a like traditional classroom.

Eisle (1984) believes that the use of computers to deliver education content has become a fairly well accepted mode. Two of the needed areas of scholarly investigation cited by Eisle include studies designed to answer how is attitude toward learning affected and how effective is the learning delivered via computer. The purpose of this investigation was to measure and compare the pre and post course differences in student attitude and achievement in a Internet-based college level course.

Methodology

A one-group pretest-posttest design was established to determine differences in student attitudes and achievement in an Internet-based college level course. Participants were voluntarily recruited from enrolled learners in a senior level neurological rehabilitation course in physical therapy at Arkansas State University during the summer session. The lead investigator of the study was also the primary instructor for the selected course, however, barriers were

implemented to keep the instructor blind to the identity of the voluntary participants to limit biasing effects. Participants in the study were asked to complete a pre and post course attitude survey and a pre course test of knowledge. No rewards or credit were given to the learners for active participation in this investigation. All learners, regardless of their status in the investigation, were required to complete the post course test of knowledge for course credit. This study was approved as an exempt research project utilizing human subjects by the Institutional Review Board for the Protection of Human Subjects (IRB) at Arkansas State University.

Tools used in this investigation to collect data consisted of a pre and post course attitude survey and test of knowledge. The attitude survey was based on the tool to measure achievement motivation originally described by Ory and Poggio (1975) and later revised by Rampp and Guffey (1999). The tool consists of an "A" form and a "B" form of 50 unique questions covering a range of 15 domains that were originally identified by Ory and Poggio in the literature as factors related to achievement motivation (Appendix A). The participant had to make a forced choice Likert-type response (1 = always, 2 = often, 3 = seldom, 4 = never) related to their self reported perception or attitude toward learning (Appendix B). All questions were designed to be unidirectional with an overall lower score reflective of an enhanced achievement motivation or positive attitude toward learning. The test of knowledge was developed by the instructor of the course (lead investigator) from a table of specification (TOS) related to the established learning objectives of the course. Items consisted of 150 objective multiple choice or multiple true and false type questions and three subjective open ended essay questions. Objective items were graded by electronic scanning system and the subjective items were graded by the instructor keeping the identities of the participant blind until all essays were graded and recorded in the grade book. Pre test subjective items were not graded by the instructor until after the completion

of the course and pre test objective scores were withheld from the instructor until after the completion of the course for data compilation. The same test of knowledge was used for both the pre and post course evaluation. The total length of time between the pre and post test of knowledge was 6 weeks and no participant had access to the pretest of knowledge nor were the pretest scores issued to the participants.

At the beginning of the course prior to any instruction, learners were issued an informed consent for voluntary participation by an independent proctor keeping the instructor blind from learner decisions to either participate or not participate in the investigation. Learners (n = 24) who voluntarily participated in the investigation were then instructed on the location and time to take the pretest for attitude (Form A) and achievement which was proctored by a neutral person to keep the instructor blind to the nature of the participants. All data collection pre and post tools were completed in a synchronous manner with traditional pen and paper due to unresolved security issues with asynchronous testing. Upon the completion of the pre course attitude survey and test of knowledge, regular course instruction was initiated in an asynchronous manner through the Internet. Course instructional design consisted of asynchronous content delivery through Web Course in a Box™ with designed learner interaction occurring through e-mail, discussion boards, and telephone as needed. The course content was divided into fourteen learning modules to be completed by the learner prior to the completion of the course. While the learners were encouraged to complete the modules in numerical order, the learners had the freedom to complete each unit in an order of their own choosing and at their own pace during the semester. Each learning module consisted of specific learning objectives, reading or other outside assignments, and reflective discussion questions. The learner was required to respond to each discussion question posted by the instructor and post at least one follow up response to a fellow

classmate. Upon completion of the course, the post course attitude survey (Form B) and the regular course final exam (post test of knowledge) were completed. Data was entered into SPSS 9.0 and statistical differences were analyzed using a matched pairs T-Test. The significance level was established at the .05 level (Trochim, 1999).

Results

All data was collected and analyzed to compare for correlations and significant differences between the mean paired differences of the pretest scores and posttest scores using a paired samples t-test. Attitude surveys were examined by overall score (Appendix C) and by individual attitudinal domain score (Appendix D) for the pre and post assessment. The test of knowledge scores were examined comparing the differences in the mean scores to identify the presence or absence of significant learning (Appendix E).

Significant data was produced relating to changes in attitude and changes in achievement. In examining the data produce by the overall attitude toward education, a significant difference existed (.004) between the paired differences means with the posttest scores being statistically less than the pretest scores (mean diff = 5.000, std dev. = 7.650, std. error = 1.562, t = 3.202, df = 23, sig = .004). A significant correlation was also produced (r = .477, sig. = .018) demonstrating a positive relationship between the overall pre and post attitude scores (Graph 1, Appendix C). Within the individual domains described by Ory and Poggio (1975), significant differences were observed between the pre and post test scores in 8 of the 15 domains. Significantly lower scores were observed in the domains relating to fear of failure, social acceptance, future orientation, competitiveness, and anticipatory behavior. Significantly higher scores were observed in the domains relating to parental affection, reaction to success or failure, and parental restriction. One

significant correlation was produced during the examination of the individual domains with a positive relationship existing for the domain of task orientation (r= .473, sig. = .019) (Graph 2, Appendix D). Total number of viable case dropped to n = 23 for the analyzing the data set for test of knowledge as it was found that one participant did not attempt to complete the pretest of knowledge. Achievement scores relating to the test of knowledge were significantly improved when comparing pretest to posttest data (mean diff = 79.957, std dev. = 8.014, std. error = 1.671, t = 47.848, df = 22, sig = .000). A significant positive correlation also existed describing the data set for the pre and post test scores for the test of knowledge (r= .443, sig. = .034) (Graph 3, Appendix E).

Discussion

There are two significant overall observations that can be made from the collected data. First, according to the attitude measurement tool originally designed by Ory and Poggio (1975), a positive change in overall attitude toward education occurred. Second, learning of the related content occurred as demonstrated by the significant differences in pre and post test of knowledge scores. This is in support of several authors that claim that asynchronous instruction delivered over the Internet is effective both from an examination of student perceptions and achievement. Dominquez (1999) and Wegner et al. (1999) both reported that online learning is at least as effective as the more traditional face-to-face approach.

The composite score on the pre and post attitude tool identified that the participants in the study demonstrated an improved attitude toward education (lower overall score). A closer examination of the significant improvement related to individual attitude domains in the self-reported attitude of the learners produces some confounding evidence. While the composite mean

differences from pre to post assessment were significant, only 5 domains demonstrated significantly lower or improved scores while 3 domains demonstrated significantly higher or lessened scores. The first domain that contributed to the improvement of overall attitude was fear of failure which was originally described as elements relating to self-doubt or uncertainty in learning. Students appeared to demonstrate an improved feeling regarding self doubt. The second domain demonstrating improved scores was social acceptance or issues related to the "social self" demonstrating intrinsic versus extrinsic motivation for learning. Students collectively demonstrated moving along a spectrum from being a more extrinsic learner to a more intrinsic learner. The third domain demonstrating improved scores was related to future orientation or matters related to the passing of time. Ory and Poggio (1975) described that students with higher motivation for learning tend to be more concerned with issues related to time than lower achievers. Students in this investigation demonstrated a greater concern for the movement of time at the end of the investigation. Items related to competitiveness comprised the fourth domain demonstrating improved scores. By demonstrating an overall decrease in scores, the learners appeared to be more competitive upon the completion of the course which is reflective of a higher motivation for learning as described in the original works by Ory and Poggio (1975). The last domain demonstrating improved scores was issues related to anticipatory behavior or those elements concerned with preparation for something in the future. Students who participated in this investigation appeared to be more cognizant of preparing for tasks in the future.

Three domains demonstrated significantly greater scores upon the completion of the post-course attitude assessment tool. Items describing reaction to success or failure demonstrated an increased score reflecting a lessening of achievement motivation. Collectively, by demonstrating a greater score on this domain the collected data suggests the students had lower attitudes toward

education by attempting easy projects after successes and more difficult projects after failures. Parental affection and parental restriction, which are both reflective of the students recollection of interaction with their parents, both demonstrated significantly increased scores when comparing the pre and post course tools. The movement within this domain from pre to post assessment is unexplainable in terms of improved or decreased attitude, as both domains should be relatively constant in terms of the perceptions that student had of their parents while growing up. Instrumentation threats to validity are most likely the cause for this observed variation. It is also important to discuss the nature of the improvements in attitude that are directly related to the implementation of the technology itself. Technologically enhanced instruction and positive student satisfaction does not necessarily implicate the technology itself, but rather a multi-factor analysis including learning tasks, learner characteristics, student motivation, the style of the instructor, and the art of teaching or instructional design (Phipps & Merisotis, 1999). From the observed data regarding attitudinal changes, either positive or negative, a causal relationship must be carefully applied in terms of the multifaceted nature of determining the true nature of attitude toward learning.

Analyzing the significant data related to the enhanced levels of achievement demonstrated by the learners suggests that this mode of instruction was effective. The use of learning modules inclusive of learning objectives, selected readings, and reflective discussion questions posted in an asynchronous manner demonstrated a significant difference in achievement. For the 23 learners completing the pretest of knowledge, an average score of 95.78 out of 200 was achieved. However, upon completion of the asynchronous delivery of instruction, the same 23 learners achieved an average score of 175.74 out of 200 on the identical achievement assessment tool.

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Limitations of this investigation are forwarded from the threats inherent in the design of a single group study. The ability to generalize the observed data is limited as the single-group pretest/posttest design has limited non randomized, internal controls. Trochim (1999) establishes six threats to the internal validity of a single group experimental design: 1) history, 2) maturation, 3) testing, 4) instrumentation, 5) morality, and 6) regression. The history threat was minimized in this investigation due to the complex and unique nature of the materials being presented (advanced neurological rehabilitation) and it was unlikely that another outside historical event produced the observed changes in the achievement. The maturation threat would have ideally been minimized through a randomly selected control group, however, the course offering for this selection of students consisted of only one section and the students were required to complete the course for matriculation in the professional program. A like control group that did not take the course was not feasible. Attempts were made to limit the inherent testing threat by 1) preventing the learners from reviewing the pretest of knowledge after completion, 2) observing a time duration between pre and post test (6 weeks), and 3) establishing a large number of items on the achievement test (150 objective / 3 subjective). The testing threat was more prevalent when using the attitude tool as this could have made the learner more aware of the nature of questions on the self reported questionnaire. As originally designed by Ory and Poggio (1975) this threat would significantly limit the validity of the tool in a single group study. The modifications made by Ramp and Guffey (1999) to the assessment tool establishing two different unique versions significantly reduce the testing effect in a single group study. However, the same method to reduce testing threat in assessment, produces a significant rise in instrumentation threat. There is concern related to the observed changes measured by the assessment tool forms A and B. Some of the domains present with relatively few items on each

respective form which may significantly limit the sensitivity of the tool to reflect accurate changes in attitude. The threat posed by instrumentation related to achievement was reduced by using an identical pre and post test of achievement. The morality threat which relates to the drop out rate skewing the observed changes was negligible as all students that completed a pre-course tool (either assessment n = 24, or achievement n = 23) completed the appropriate post-course tool. Lastly, threats posed by the regression toward the mean was also minimized by the high academic level of the students who participated in the investigation.
(Trochim, 1999; Kirkpatrick, 1998)

A second area of limitation for this study includes the relative nature of the participants. The students in this investigation are upper level physical therapy students learning content in a professional course that is critical to their future performance in the clinic. The motivation of success for this group of students is generally high and may not be the same for all students in all learning opportunities. Therefore the gains observed in attitude and achievement should not be an indication that this method of instruction will operate effectively in all learning settings. The nature of distance education relies on the independence and motivation of the learner. The distance education student must embrace the freedom and opportunity to learn on an independent schedule determining when and how to seek out information; however, some students may not be pedagogically equipt to assume this great responsibility (Moore & Kearsley, 1996). Clark (1991) and Salomon (1984) believe that the mode of delivering educational content is not solely responsible for motivating students to learn. The student's beliefs about their chances to learn and succeed from any given media are different for different students and for the same students at different times. Motivation for success is likely to be a interaction between educational technology and the perceptions of the student.

While it is imperative that comparative studies investigating the effectiveness of Internet-based learning be of sound research design with randomized selection, further areas of investigation should include the characteristics of the learning experience related to the attitude and achievement of the learner. Synergistic relationships between multi-modal technologically enhanced instruction does not appear often in the literature, but rather investigations related to the interaction between the learner and one instructional mode versus another. Individual student factors and characteristics related to success and failure in a distance learning environment need to be identified rather than group characteristics and averages of the "typical" learner. Stevenson (1999) believes that the area of self selection in online courses needs to be further investigated. Addressing attrition and drop out rates in distance learning programs compared to traditional classroom instruction is needed. Individual learning styles related to the use of technology in the classroom should be investigated as well.

Conclusion

The purpose of this investigation was to measure the change in attitude and achievement of traditional students enrolled in an Internet-based asynchronous course. This single group investigation demonstrated that learning at a distance through technologically enhanced mediums is effective in promoting an improvement in attitude and an improvement in knowledge. It is certain that more than one medium could produce like results and the scholarly community should avoid generalization and not partake from this observation as one instructional medium being superior to another. Clark (1999) supports this argument by claiming that ". . .the point is that no matter who or what is being taught, more than one medium will produce adequate learning results."

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Appendix A

Identified Domains Related to Achievement Motivation

(Ory and Poggio, 1975)

1. Task Orientation
2. Perseverance
3. Parental Affection
4. Fear of Failure
5. Social Acceptance
6. Reaction to Success or Failure
7. Future Orientation
8. Involvement
9. Parental Restriction
10. Test-Taking Behavior
11. Competitiveness
12. Independence
13. Rigidity
14. Unidentified Subset
15. Anticipatory Behavior

Appendix B

Attitudes Toward Education

Form A

Last 4 digits of ID#

__ __ __ __

Directions:
This tool is designed to evaluated what student's believe about the various aspects of learning in an educational environment. Completion of this tool will assist in gaining a better understanding related to individual attitudes about learning. This survey is expected to be anonymous and personal identification is limited to the last four digits of your social security number. These numbers will be used exclusively to measure change in attitude during the course of learning. Please complete the following self assessment by writing the appropriate number from the scale below in the space provided next to each question. It should take about 15 minutes to complete the entire survey

Please use the following scale when answering the questions about yourself:
1 = always
2 = often
3 = seldom
4 = never

1 ____ I often choose moderately difficult tasks rather than very difficult ones.
2 ____ I have found myself short of time on a test because I spent too much time on one or two problems.
3 ____ I would rather work on a commission basis with a chance for a large income than work on a fixed salary with a lower, but steady income.
4 ____ I often feel at peace with myself.
5 ____ If I were a teacher, I would rather have good students, than freedom and flexibility in the job.
6 ____ My parents (guardian) seldom discouraged me from doing new things as I grew up.
7 ____ I prefer games of skill to games of chance.
8 ____ Getting an "A" in a course is always possible for me.
9 ____ I can accomplish simple manual tasks faster than most people.
10 ____ I become frustrated easily.
11 ____ I prefer to watch sports on television, rather than participate myself.
12 ____ My parents (guardians) allowed me to make my own friends.
13 ____ I prefer to work on difficult projects with someone, rather than trying them alone.
14 ____ I am (was) frequently the first person done with a test.
15 ____ Being popular is more important than just being successful.
16 ____ I am not as much concerned about the present as I am about the future.
17 ____ I have courage.
18 ____ I have often followed my parents' (guardians') advice even whin I disagreed with it.
19 ____ I feel as though I can take short breaks after successfully completing one stage of a large project.

20 ___ While working on a project, I often get side-tracked by new ideas.
21 ___ I like to live by the saying, "Never give up."
22 ___ I always lacked closeness with my parents (guardians).
23 ___ Often I am disappointed in my ability to interact with others.
24 ___ I consider myself open to new ideas or beliefs.
25 ___ In school, I am (was) active in extra-curricular activities.
26 ___ I would rather change my opinion than disagree with the consensus of a group.
27 ___ It is more important to have friendly co-workers than flexibility in the job.
28 ___ If I cannot solve a particular problem, I would rather try an easier one than keep working on the harder task.
29 ___ I frequently find myself doing something now, in preparation for the future.
30 ___ My parents (guardians) expected a lot from me when I was young.
31 ___ I seldom ask for someone's help while I am working on a problem.
32 ___ I would often work very hard at something just for my parents' (guardians') approval.
33 ___ One cannot be truly successful if s/he is not also popular.
34 ___ I will frequently make a very easy task more difficult to make it more interesting.
35 ___ Very difficult problems are more motivating than moderately difficult problems.
36 ___ Generally, I feel compelled to know the exact time.
37 ___ I prefer a well written book to a good movie.
38 ___ Social acceptance is more important than personal success.
39 ___ I will often do my best in order to avoid the embarrassment of failure.
40 ___ I enjoy competing against the clock.
41 ___ After participating in athletics, I find it much easier to accept defeat if I have played well.
42 ___ My parents (guardians) rewarded me with a hug or a similar show of affection for doing something well.
43 ___ I often pack my suitcase days before I am ready to leave.
44 ___ I feel that I can succeed at almost anything I try.
45 ___ It is important to finish something once it is started.
46 ___ After successfully completing a task, I like to relax for a short period before attempting something new.
47 ___ I consider myself an independent thinker.
48 ___ I will often attempt a difficult problem after failing at an easier one.
49 ___ I realize the limits of my own ability and knowledge.
50 ___ I enjoy solving problems that some people would consider impossible.

Thank you for taking the time to complete this survey. Your help is greatly appreciated. You are free to receive an analysis of your individual responses after the completion of both the pre and post survey. Please contact the investigators of this study and furnish them with the last four digits of your social security number. Individual analysis of the results will only be performed by specific request. For the purpose of this investigation, a collective analysis is being performed.

Attitudes Toward Education

Form B

Last 4 digits of ID#

__ __ __ __

Directions:
This tool is designed to evaluated what student's believe about the various aspects of learning in an educational environment. Completion of this tool will assist in gaining a better understanding related to individual attitudes about learning. This survey is expected to be anonymous and personal identification is limited to the last four digits of your social security number. These numbers will be used exclusively to measure change in attitude during the course of learning. Please complete the following self assessment by writing the appropriate number from the scale below in the space provided next to each question. It should take about 15 minutes to complete the entire survey

Please use the following scale when answering the questions about yourself:

1 = always
2 = often
3 = seldom
4 = never

1 ____ I am highly motivated when I know that a task is difficult.
2 ____ I am physically more active than most people.
3 ____ I prefer to work alone.
4 ____ I often find myself speaking in the future tense.
5 ____ Successful completion is the primary goal of any undertaking.
6 ____ I will often keep working at something even if it seems hopeless.
7 ____ I am motivated more by social pressures than by personal needs.
8 ____ I find it easier to make decisions after getting someone's advice.
9 ____ I would rather take a multiple-choice test than an essay exam.
10 ____ My parents (guardians) were seldom affectionate with me.
11 ____ I believe that I succeed at tasks more times than if fail.
12 ____ I would rather have the teacher set the deadlines than set them myself.
13 ____ I view my parent's (guardians') lives as unproductive.
14 ____ I would rather work for a company that pays well, than work for a company that pays less but affords job flexibility.
15 ____ I feel my parents (guardians) were very restrictive in raising me.
16 ____ I am often the last person to finish a test.
17 ____ I am usually realistic about my goals and aspirations
18 ____ I feel that I am more likely to succeed at any given task than are most people.
19 ____ After a considerable amount of time on a problem, I prefer to move on to an easier one.
20 ____ I prefer web based or self paced academic courses to traditional lecture classes.
21 ____ I feel that I am being very realistic with my career choice in relation to my ability.
22 ____ My parents (guardians) are (were) friendly.
23 ____ I dislike giving up on a task.

24 ___ When the odds are against me in games of skill, I am highly motivated to do my best.
25 ___ A true challenge is one that is practically impossible to accomplish.
26 ___ I enjoy(ed) classes in school with a mixture of students with varying abilities.
27 ___ Unfinished tasks bother me until I get a chance to finish them.
28 ___ I consider myself very conscious to time.
29 ___ My father (male guardian) is (was) very dominating and strict.
30 ___ I will often spend days just thinking and organizing before beginning the work of a project.
31 ___ Other people influence my opinions more than I would like them to.
32 ___ I enjoy completing many easy tasks rather than just a few difficult ones.
33 ___ My parents (guardians) never seemed very confident of their own abilities.
34 ___ It is important to have long range goals clearly in mind.
35 ___ Monetary rewards are the best way to motivate me to do my best.
36 ___ I do not mind putting in extra hours and work if it helps me finish a task.
37 ___ In school, I have usually taken advantage of self paced course options.
38 ___ I generally aim my activities toward a future goal.
39 ___ When younger, I felt very guilty when I disobeyed my parents (guardians).
40 ___ I will work longer on problems I believe I can solve, than on those I consider close to impossible.
41 ___ I will often do things for the present enjoyment and not be concerned with future consequences.
42 ___ Tasks are performed best through group efforts rather than through individual effort.
43 ___ Games are not much fun if the competition is too strong.
44 ___ It is often too much trouble to disagree with a group opinion.
45 ___ I would rather fail at a difficult task than succeed at an almost effortless task.
46 ___ Success encourages me to attempt even more difficult problems.
47 ___ I enjoy being in groups with people of equal ability.
48 ___ I would rather be unpopular with my own opinions than be popular with someone else's opinions.
49 ___ I enjoy trying to solve problems some people would consider impossible.
50 ___ My parents (guardians) gave me considerable independence early in life.

Thank you for taking the time to complete this survey. Your help is greatly appreciated. You are free to receive an analysis of your individual responses after the completion of both the pre and post survey. Please contact the investigators of this study and furnish them with the last four digits of your social security number. Individual analysis of the results will only be performed by specific request. For the purpose of this investigation, a collective analysis is being performed.

Appendix C

T-Test
Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Attitude Survey A	115.5833	24	6.5203	1.3310
Attitude Survey B	110.5833	24	8.1769	1.6691

Paired Samples Correlations

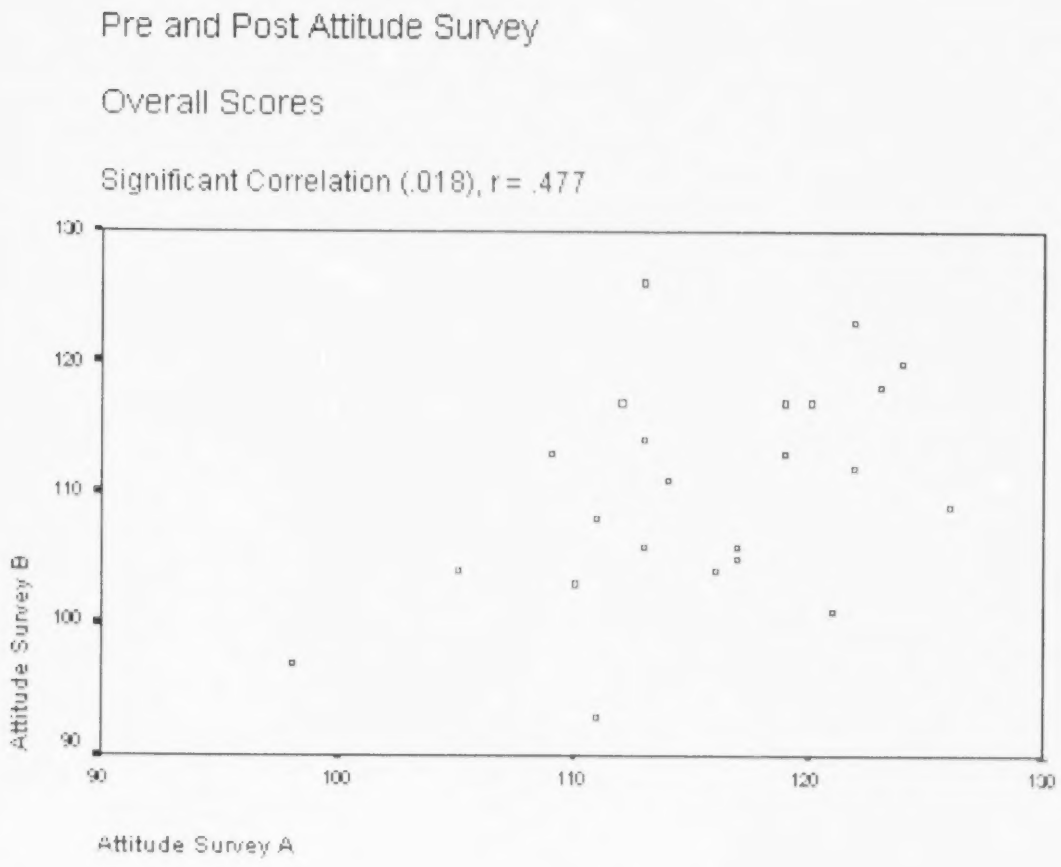
	N	Correlation	Sig.
Attitude Survey A & Attitude Survey B	24	.477	.018

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Attitude Survey A & Attitude Survey B	5.0000	7.6500	1.5615	1.7697	8.2303	3.202	23	.004

Appendix C

Graph 1



Appendix D

T-Test
Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Task Orientation A - B	2.4583	7.9125	1.6151	-.8828	5.7995	1.522	23	.142
Perseverance A - B	-.4167	2.1042	.4295	-1.3052	.4718	-.970	23	.342
Parental Affection A - B	-1.2917	2.3309	.4758	-2.2759	-.3074	-2.715	23	.012
Fear of Failure A - B	1.2917	1.8528	.3782	.5093	2.0740	3.415	23	.002
Social Acceptance A - B	17.3750	7.5804	1.5473	14.1741	20.5759	11.229	23	.000
Reaction to Success or Failure A - B	-3.1250	5.1102	1.0431	-5.2828	-.9672	-2.996	23	.006
Future Orientation A - B	3.8333	7.4406	1.5188	.6914	6.9752	2.524	23	.019
Involvement A - B	2.1250	7.2009	1.4699	-.9157	5.1657	1.446	23	.162
Parental Restriction A-B	-5.7500	3.5294	.7204	-7.2403	-4.2597	-7.981	23	.000
Test-Taking Behavior A-B	.3333	2.2001	.4491	-.5957	1.2624	.742	23	.465
Competitiveness A - B	3.2917	5.0689	1.0347	1.1513	5.4321	3.181	23	.004
Independence A - B	1.1667	3.4093	.6959	-.2729	2.6063	1.676	23	.107
Rigidity A - B	1.7083	4.6483	.9488	-.2545	3.6711	1.800	23	.085
Unidentified A - B	-.2500	2.0054	.4094	-1.0968	.5968	-.611	23	.547
Anticipatory Behavior A-B	.9583	1.1221	.2290	.4845	1.4321	4.184	23	.000

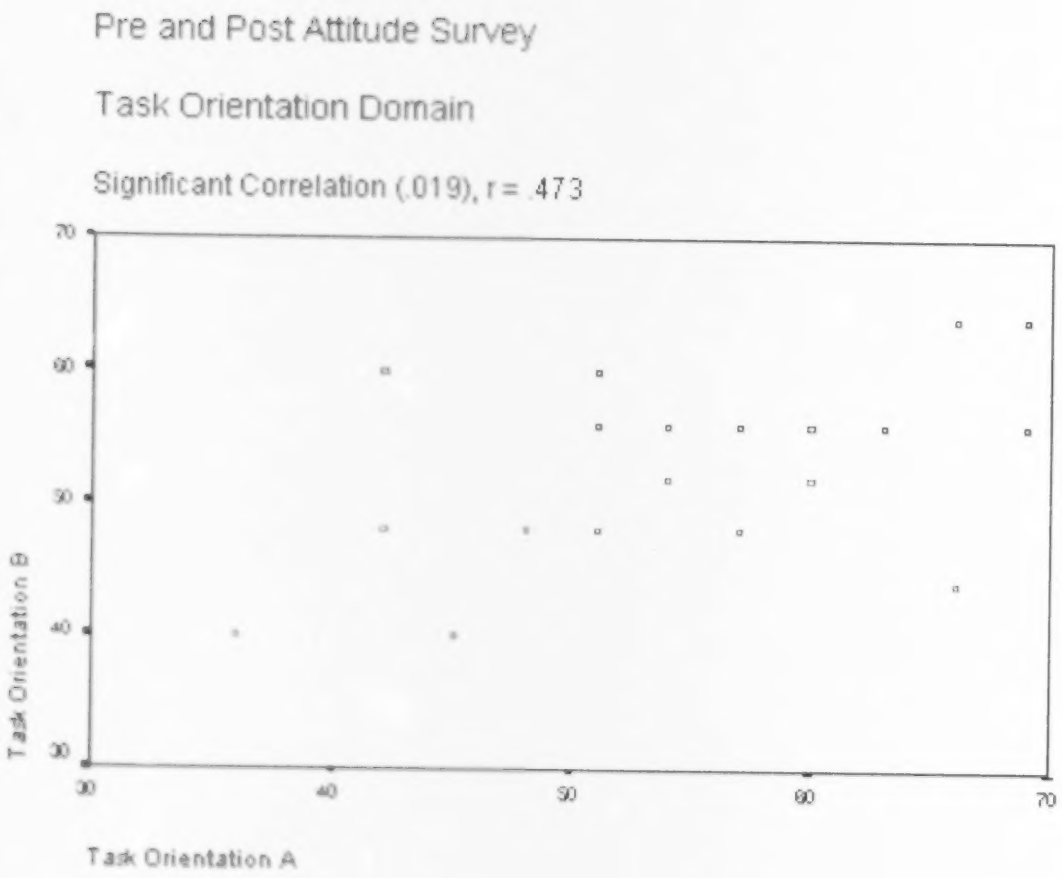
Appendix D

T-Test
Paired Samples Correlations

	N	Correlation	Sig.
Task Orientation A - B	24	.473	.019
Perseverance A - B	24	.192	.370
Parental Affection A - B	24	.096	.657
Fear of Failure A - B	24	.165	.442
Social Acceptance A - B	24	.335	.110
Reaction to Success or Failure A - B	24	.399	.053
Future Orientation A - B	24	.138	.521
Involvement A - B	24	.101	.639
Parental Restriction A-B	24	.162	.451
Test-Taking Behavior A-B	24	-.214	.314
Competitiveness A - B	24	-.398	.054
Independence A - B	24	.214	.315
Rigidity A - B	24	.230	.280
Unidentified A - B	24	-.271	.201
Anticipatory Behavior A-B	24	.044	.838

Appendix D

Graph 2



Appendix E

T-Test
Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Post Test of Knowledge	175.7391	23	7.7414	1.6142
Pre Test of Knowledge	95.7826	23	7.4343	1.5502

Paired Samples Correlations

	N	Correlation	Sig.
Pre & Post Test of Knowledge	23	.443	.034

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pre & Post Test of Knowledge	79.9565	8.0141	1.6710	76.4910	83.4221	47.848	22	.000

Appendix E

Graph 3